1. What are the session key findings? What are the new Lesson(s) learned / Scientific progress (since AR5 release, if relevant)?

- Permafrost may be large positive carbon-climate feedback
- No evidence for large-scale thresholds in total permafrost carbon losses, but relatively linear with warming
- Large differences in outcomes between medium-emissions (RCP4.5) and high-emissions (RCP 8.5) scenarios
- Once thawed, emissions from permafrost continue for a long time and are of similar magnitude, but slower than, carbon responses of tropical forests
- Soil moisture and temperature responsible of considerable uncertainty in predicting soil carbon changes
- Soil moisture effect strongly depends on soil characteristics
- Need and challenge of scaling up small scale approaches to global scale
- Effect of agricultural practices on soil carbon budget depends strongly on the pedo-climatical context
- The global carbon budget is monitored each year and the sink efficiency of the land and oceans are quantified. Sink efficiency is a better metric than airborne fraction and has shown a measurable decreasing trend in recent years
- Biogeochemical feedbacks beyond CO₂ are also important in the earth system and can contribute to significant changes in future radiative forcing. DMS emissions from ocean plankton are perhaps more sensitive to ocean pH than previously thought and this might represent a new feedback process not considered in models.
2. What are the major knowledge Gaps and Research Needs identified in the session?

Current models of global carbon cycle feedbacks do not include permafrost carbon pool and its role as a feedback agent. Fate and decomposability of frozen carbon is not well known, and above ground processes (insulation from snow and vegetation) are also of central importance but not well represented in models. Scaling up small-scale approaches to global scale is challenging and badly needed to better represent soils in Earth System Models.

3. Did the session discuss/identify promising approaches in the fields of Adaptation and Mitigation, or both?

Mitigation of climate change requires the knowledge of how natural carbon sinks, and other biogeochemical feedbacks, will respond in the future so that we can quantify emissions reductions required to meet climate targets. The concept of TCRE (Transient Climate Response to Emissions, see e.g. IPCC AR5 WG1 figure SPM.10) addresses this issue but has large uncertainty. This session presented results of new process and monitoring studies which will enable better quantification of future carbon cycle feedbacks to inform mitigation policies.

4. Are there take-home messages from the session?

(When relevant, please specify targeted group of stakeholders. For example, policy-makers / COP21 negotiators, practitioners (experts, etc.), NGOs, private sector, citizens, media, etc.)

Biogeochemical feedbacks have a major influence in greenhouse gases content in the atmosphere. The magnitude of this feedback is still unsatisfactory constraints due to scientific knowledge gaps. One major gap, the magnitude of future carbon release from thawing permafrost is beginning to receive widespread research and modeling.

5. Are there Important Quotes from the session?

“Blimey it’s hot in here!”

6. Please include any other remark that you might have.